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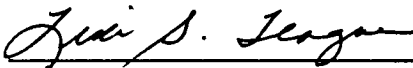
A Report Prepared for

Commanding Officer
Western Division
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, California 94066

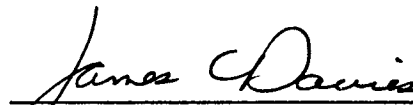
**SUBSURFACE INVESTIGATION
PROPOSED GALLEY
HUNTERS POINT NAVAL SHIPYARD**

HLA Job No. 2176,119.02

by



Lisa S. Teague
Geologist - 3839



James C. Davies
Principal Engineer

Harding Lawson Associates
7655 Redwood Boulevard
P.O. Box 578
Novato, California 94948
415/892-0821

July 30, 1987

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William F. Frizzell
William F. Frizzell
Engineer



INTRODUCTION

This report presents the results of Harding Lawson Associates' (HLA) investigation of an area near Building 600 (Bachelors Enlisted Quarters), Hunters Point Naval Shipyard (Disestablished), San Francisco, California. The area is the proposed site of an Enlisted Dining Facility (Galley). The Location Map and Site Plan are presented as Plates 1 and 2, respectively. This report was prepared with the assistance of Ronald Block, Ph.D., of Aqua Terra Technologies, Inc. (ATT), Walnut Creek, California.

The site is near the shoreline in the southwestern portion of Hunters Point in an area referred to as the Bay Fill Area. The Bay Fill Area is an area of approximately 40 acres that, in the past, received several thousand tons of sandblast wastes that contained sand aggregate; steel, copper and lead grit; rust; paint scrapings; and other debris. The Bay Fill Area is one of the sites identified for further investigation under the Navy's Installation Restoration (IR) program. Current plans include the construction of the Galley in the north-central portion of the Bay Fill Area.

The purposes of this investigation were:

- 1) to confirm elevated concentrations of copper and zinc that had been previously detected,
- 2) to evaluate the lateral and vertical extent of these metals in the soil and ground water,
- 3) to assess whether remediation is warranted in the immediate vicinity of the proposed Galley,
- 4) to assess the impact construction would have on future remedial measures in surrounding areas,
- 5) to assess the risk to human health and the environment.

The area near the proposed Galley has been explored in two previous investigations:

"Confirmation Study, Verification Step, Hunters Point Naval Shipyard (Disestablished)," March 19, 1987, EMCON Associates (Borings BG and BJ, Bay Fill Area).

"Hunters Point Naval Shipyard, Soil and Water Sampling near Proposed Galley," Draft Report dated June 1987, ERM-West (Borings A-5, B-4, B-8, and D-8, and Monitoring Well C-5W).

Available data include the results of chemical analyses of soil samples collected from the two EMCON borings and from the five ERM-West borings noted above, one of which was completed as Monitoring Well C-5W. A ground-water sample was collected by ERM-West from Well C5-W; however, the sample was not filtered prior to preservation and metal concentrations reported may, therefore, be higher than actual dissolved concentrations. The locations of these borings and Well C-5W are shown on Plate 2 and copies of the analytical results are presented in Appendix A. The current investigation was initiated because elevated concentrations of copper and zinc [37,000 milligrams per kilogram (mg/kg) and 22,000 mg/kg, respectively] were detected in a soil sample from Boring BG under the EMCON study. In addition, trace levels of polyaromatic hydrocarbons (PAHs), indicative of petroleum hydrocarbons, were detected in several soil samples and one ground-water sample from the previous investigations. Total PAH concentrations were less than 2 mg/kg. According to the Regional Water Quality Control Board, San Francisco Bay Region (RWQCB)¹, concentrations of total petroleum hydrocarbons less than 10 mg/kg do not generally constitute a threat to ground water or a hazardous condition. Therefore, no further investigation for petroleum hydrocarbons is warranted for the proposed Galley site.

¹ "Guidelines for Addressing Fuel Leaks," RWQCB, September 1985.

In the EMCON study, asbestos was detected in one of the two soil samples from Boring BG. The asbestos concentration was 1 percent in the sample obtained at a depth of 4 feet but asbestos was not detected at a depth of 1 foot. The source of the asbestos is not certain; however, it may be naturally occurring because it is commonly found in serpentine, which forms much of the bedrock at Hunters Point. Serpentine fill was apparently encountered in several of the borings at the Galley site and in borings drilled elsewhere at Hunters Point.

The scope of our services included drilling four exploratory borings, sampling soil and ground water from those borings, submitting the samples for analysis, evaluating the data, and preparing this report.

FIELD PROGRAM

Four borings (G-1 through G-4) were drilled and sampled on June 5, 1987, using a truck-mounted 8-inch-diameter hollow-stem auger drill rig at the locations shown on Plate 2. Boring G-1, located 3.5 feet from Boring BG, was drilled to evaluate the data from the previous boring. Borings G-2 and G-3 were drilled about 20 feet from Boring BG to provide data on the lateral extent of the metals detected. Boring G-4 was drilled within the footprint of the proposed Galley to provide data on subsurface conditions. The total depth of the borings ranged from 15.5 to 17 feet below ground surface. Boring logs are shown on Plates 3 through 6. Borings were logged by an HLA field geologist according to the Unified Soil Classification System (Plate 7).

Soil samples were collected using a split-barrel sampler driven into undisturbed soil ahead of the auger using a 140-pound hammer. Samples were collected in the 6-inch long stainless steel tubes that line the sampler. Most of the samples were retained in the stainless steel tubes in an undisturbed condition. However, for Boring G-1, soil

from depth intervals of 7.25 to 8.25 feet and 13.5 to 14.5 feet was extruded from the tubes and mixed in a clean stainless steel bowl. Visible metal and glass particles were removed and the homogenized soil was repacked into two stainless steel sampling tubes. This was done to assure that subsequent heavy metal analysis, by nitric acid digestion and atomic absorption methodology, was performed on soil and not on debris within the soil. It is believed that pieces of metallic debris in the soil subjected to the nitric acid digestion procedure, would result in concentrations of heavy metals which would not be indicative of heavy metal contamination within the soil matrix. In addition, the Total Threshold Limit Concentrations (TTLCs), which are described later, apply only to metal in a friable, powdered or finely divided state². One sample tube from the 7.25 to 8.25 depth interval was submitted for chemical analysis and the other was submitted for use in a fish bioassay. Both tubes from the depth interval of 13.5 to 14.5 feet were submitted for chemical analysis as separate, duplicate samples. All sampling tubes were labeled and the ends sealed with foil-lined, plastic caps taped to the tube.

A ground-water sample was obtained from each of the four borings. Samples were bailed through the center of the hollow-stem augers, then decanted into 1-quart plastic bottles provided by the laboratory. Samples selected for metals analyses were filtered and preserved in the laboratory at the end of the day.

All soil and ground-water samples were stored on ice until delivery to the appropriate laboratories. Completed chain of custody documentation accompanied the samples.

² California Administrative Code (CAC), Title 22, Division 4, Article 11, Section 66699.

The augers were steam cleaned prior to use at the site. Sufficient auger sections were provided by the drilling crew so that clean augers were used for each boring. Between samples, sampling equipment was washed with Alconox and rinsed with clean tap water. The wash water and drill cuttings were placed into steel drums for later disposal. All borings were grouted with neat cement to within approximately 1 foot of ground surface. The upper foot of each boring was backfilled with native material.

SUBSURFACE CONDITIONS

The area consists of artificial fill generally comprising medium-grained sand with varying amounts of clay and gravel to the depths explored (17 feet). Shell fragments were observed in all of the borings except Boring G-4. Metal fragments and wire were observed in the soil throughout Boring G-1; trace amounts of metal fragments were also observed in Borings G-2 and G-3. Metal fragments were not observed in Boring G-4. The soils in Boring G-4 were visibly different from those in the other borings and consisted of fill composed of weathered serpentine soils.

In most of the borings from the current and previous investigations, artificial fill extends to depth explored, ranging up to 20 feet. In Boring D8 and Well C5-W, bay mud was encountered beneath the fill at depths of 11 and 13 feet, respectively.

The unstabilized water level at the time of drilling was at a depth of about 8 feet below ground surface in all borings except Boring G-4; in Boring G-4 the water level was at a depth of about 12 feet. Similar water levels were encountered during previous investigations; there is not sufficient data to obtain ground-water flow directions.

ANALYTICAL PROGRAM

Chemical analysis of the soil and ground-water samples was performed by Curtis & Tompkins, Ltd., of San Francisco, a laboratory certified by the State for hazardous waste analyses. These samples were analyzed by atomic absorption spectrophotometry for heavy metals. Additional extraction tests (by Curtis and Tompkins) and a fish bioassay (by ATT) were performed on the soil sample from the depth interval of 7.25 to 8.25 in Boring G-1. This sample was chosen for these additional analyses because the soil sample from a similar depth in adjacent Boring BG contained elevated concentrations of copper and zinc. A waste extraction test (WET) using the standard citric acid digestion protocol described in CAC Title 22, Division 4, Article 11, Section 66700 was performed on a portion of the soil. A modified extraction test was also performed on a portion of the soil sample; San Francisco Bay water collected at Hunters Point was used as the extraction medium. Extraction with Bay water was considered to more appropriately address potential leaching from soil and sediment than would the WET.

A portion of the soil sample from the depth interval of 7.25 to 8.25 feet of Boring G-1 was also submitted to ATT for a hazardous waste fish aquatic toxicity test (bioassay) as described in CAC, Title 22, Division 4, Article 11, Section 66696.

ANALYTICAL RESULTS

Tables 1 through 3 present the results of the chemical analyses with the corresponding standards used for comparison. Analytical methods are listed on the copies of certified laboratory reports (Appendix B). The results of the fish bioassay are presented in Appendix C.

Soil

The elevated copper and zinc concentrations previously detected in Boring BG at a depth of 7 feet were not confirmed by samples collected at a similar depth in adjacent Boring G-1. Soil samples from similar and other depths in nearby Borings G-2 and G-3 also did not contain high concentrations of these metals. Soil samples collected from Borings G-1, G-2, and G-3 contained variable amounts of metal flakes, wire, and fragments. If the sample from Boring BG at 7 feet deep also contained metallic debris, the nitric acid digestion process (EPA Method 3010) would have caused some of the metal fragments to solubilize, resulting in excessive metal concentrations not indicative of metals in the soil matrix. It is believed that the previously reported elevated copper and zinc concentrations resulted from this acid digestion process. Such metal pieces are not in a form that is soluble under current site conditions, as supported below in the discussion of the WET results.

The metal concentrations were compared with the TTLCs, which represent the levels above which a waste is classified as hazardous. As shown on Table 1, the soil samples contained metals at concentrations below their respective TTLCs. In addition, with the exception of the copper and zinc in the previous soil sample from Boring BG, all of the soil samples from previous investigations contained metals at concentrations significantly below the TTLCs. Therefore, it is believed that none of the metals analyzed for should be considered present at levels that are hazardous based on their TTLC values.

Table 2 presents the results of the WET with corresponding Soluble Threshold Limit Concentrations (STLCs)³. The results of the WET show that lead was the only

³ California Administrative Code, Title 22, Division 4, Article 11, Section 66699.

metal detected at a level [5.5 milligrams per liter (mg/l)] that exceeded its STLC (5.0 mg/l). Soils with concentrations of soluble metals above their respective STLCs would be classified as hazardous waste. However, because the WET is performed using a solution with a pH of 5, it gives an indication of those metals that might be leached from the soil by an acidic liquid. To more accurately simulate chemical conditions at the Galley site, where ground water has a neutral pH and is saline, a modified extraction test was performed using San Francisco Bay water. The results of this test show that most of the metals analyzed, including lead, were not detected and those that were detected (barium, molybdenum and zinc) are present only at trace concentrations. The source of the trace levels of barium, molybdenum, and zinc in the modified extraction test is not certain because the bay water was not analyzed. However, because zinc and molybdenum were not found in any of the ground-water samples, it is doubtful that there is any environmental concern regarding their presence in the soil samples. Therefore, the results of the two extraction tests indicate that the metals present in the soils do not appear to be leachable at significant levels under current site conditions. This is further supported by the fact that only arsenic, antimony, and barium were detected in the ground water, as discussed below.

Ground Water

The shallow ground water beneath Hunters Point is not potable because of its high salinity. Previous data (EMCON, 1987) have shown that the conductivity of the shallow ground water is greater than 20,000 μ mhos, indicating that the water is very saline. A previous initial assessment study⁴ reported that there are no operational wells

⁴ "Initial Assessment Study, Hunters Point Naval Shipyard (Disestablished)", October 1984, WESTEC Services, Inc.

on or within one mile of the Hunters Point Naval Shipyard. A spring within one mile of the shipyard is used for drinking water but it is reportedly upgradient of the shipyard and would not be affected by site conditions.

The results of the analysis of the ground-water samples collected in this investigation are presented in Table 3. Arsenic, antimony and barium were the only metals detected in the ground-water samples. Because the shallow ground water at the site is not potable, data comparison with drinking water criteria is not applicable. However, because ground water might enter the bay through the subsurface, the data were compared to available information on the toxicity of metals in the bay environment.

Arsenic was found in the ground water from Boring G3 during this investigation, but was not detected in the other three borings nor in a previous ground-water sample from Well C-5W (Appendix A). The concentration detected, 0.16 mg/l, is about one-third the concentration at which arsenic may be toxic to some saltwater species (0.508 mg/l)⁵. In addition, the concentration of arsenic in the ground water is within the effluent discharge limitations proposed by the RWQCB's Basin Plan. An allowable daily average discharge of 0.02 to 0.2 mg/l of arsenic is consistent with the saltwater quality objectives of the proposed Basin Plan.

Antimony was detected in two of the four ground-water samples at concentrations of 0.16 and 0.21 mg/l. Although no saltwater data are available, studies have shown that antimony is nontoxic to freshwater species at concentrations up to 9 mg/l⁵. Because freshwater aquatic species are generally more sensitive than saltwater

⁵ U.S. Environmental Protection Agency, Water Quality Criteria Document, Federal Register, November 28, 1980, Volume 45, No. 231, p. 79325.

species, this would be a conservative estimate of the toxicity of antimony in saltwater. The detected antimony concentrations are almost 50 times lower than this level and are not considered a threat to human health or the environment.

Barium was detected in two of the four ground-water samples at concentrations of 0.30 and 1.4 mg/l. Barium has been reported to be nontoxic. The U.S. Environmental Protection Agency has studied the toxicity of barium extensively in their drilling mud toxicity program conducted in the Gulf of Mexico and has found that barium sulfate applied to benthic marine species produces no mortality.⁶

Bioassay

The results of the fish bioassay are presented in Appendix C. The purpose of the bioassay was to evaluate the acute toxicity of the soil on fish and to determine if the soil would be considered hazardous under Section 66696 of Title 22 of the CAC. Test results showed that fish mortality was low or zero at exposure concentrations of 250 mg/l⁷ and 500 mg/l, respectively. At an exposure concentration of 750 mg/l, fish mortality was 40 percent. The 96-hour LC₅₀ value, that is, the exposure concentration that results in a 50 percent mortality rate, is greater than 750 mg/l. According to the CAC (Title 22, Division 4, Article 11, Section 66696), a material is toxic and hazardous if its 96-hour LC₅₀ is less than 500 mg/l. Based on the data, the soil is not toxic and nonhazardous.

⁶ Personal communication (Dr. Ronald Block) with Dr. Norman Richards, U.S. EPA Gulf Breeze Marine Laboratory, Pensacola, Florida.

⁷ In bioassay studies mg/l refers to milligrams of soil per liter of water.

Assessment of Metals Contamination

The soils in the vicinity of the proposed Galley site do not contain metals at concentrations exceeding the TTLCs, except for Boring BG. It appears that the elevated copper and zinc concentrations in Boring BG resulted from solubilized metal fragments. In the extraction tests, only lead exceeds its STLC; lead was present at a concentration (5.5 mg/l) only slightly above its STLC (5.0 mg/l) in the WET and was not detected in the modified extraction test. Other metals were either not detected or were present at trace levels in the modified extraction test. Because the modified extraction test is believed to more closely represent actual site conditions than the standard WET, the low to nondetectable concentrations in the modified extraction test indicated that these metals are not likely to leach at significant levels into the ground water or into the bay. This conclusion is further supported by the results of the ground-water analyses, which showed that these metals were not detected or were present at low concentrations.

Arsenic, antimony and barium were the only metals detected in the ground-water samples. Because ground water might migrate into the bay, the concentrations were compared with available toxicity data; these three metals were present at concentrations significantly lower than the levels shown to be toxic to aquatic life. Drinking water criteria are not applicable because the ground water is not potable due to its high salinity. The results of the fish bioassay showed that the soil is not hazardous.

RISK ASSESSMENT

The data obtained in the current and previous investigations were used to evaluate the potential threat to human health and the environment from the metals in the soil and ground water.

The three potential means of human exposure to ground water and soils are inhalation, ingestion, and dermal contact. The ground water is several feet below the ground surface and is saline. No known domestic wells were located in the area and it is believed that ground water is not used for domestic consumption and will not likely be used in the future. Exposure to ground water is considered very improbable and, therefore, it presents no potential risk to human health. Contaminants in the soil were not present in concentrations significant enough to warrant concern for the future Galley. In addition, construction of the Galley building will essentially encapsulate the area, making soil ingestion, inhalation, or dermal contact improbable.

Contaminants might enter the bay environment by transport with soils by surface water runoff or by ground-water migration in the subsurface. Although the site is near the shoreline, the potential for surface water runoff carrying site soils into the bay is very low. The site and surrounding area are flat and under existing conditions, surface water runoff from the site has not resulted in an erosion problem. Ground water may be entering the bay; however, as shown by the ground-water analyses, the trace levels of metals present at the site do not present a threat to saltwater organisms. Therefore, there is no recognized environmental risk posed by surface water runoff or ground-water seepage from the proposed Galley site into the bay.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of the data collected in this and previous investigations, no remediation of the proposed Galley site is recommended. In the current investigation, the concentrations of metals in the soil are below the TTLCs and STLCs, except for lead; as described above, lead only slightly exceeded the STLC in the WET analyses. The ground water is saline, and therefore not a potable water source, and metals

concentrations in the ground water are low. In addition, there are no recognized human health or environmental risks posed by site conditions.

The construction of the Galley should not affect additional remedial investigation outside the building or in other portions of the Bay Fill Area. Remediation of the area outside the proposed Galley structure, if required, would not be significantly affected. Because the site itself does not require remediation, remediation of the soils outside the proposed Galley could still be accomplished, if needed. If warranted, remediation of the ground water beneath the area could still be accomplished; for example, extraction would be achieved by different combinations and locations of wells. Construction should not significantly affect the subsurface environment and therefore should not adversely affect the distribution of metals in the soil and ground water. Long-term human health or environmental exposure potential should not be affected.

TABLES

Table 1. Total Metal Concentrations in Soil Samples (mg/kg)

BORING	SAMPLE DEPTH (FT)		As	Sb	Ba	Be	Cd	Cr	Co	Cu	Pb	Mg	Mo	Ni	Se	Ag	Tl	Vn	Zn
	TOP	BOTTOM																	
G-1	7.25	8.25	3.4	< 13.0	430	< 0.30	< 0.80	34	4	350	150	0.26	< 3.0	69	< 30.0	< 0.50	< 8.0	48	690
G-1	13.5	14.5	2.2	< 13.0	350	< 0.30	< 0.80	53	8.0	300	55	0.14	< 3.0	120	< 30.0	< 0.50	< 8.0	48	240
G-1	13.5	14.5	2.1	< 13.0	210	< 0.30	41	< 3.0	< 3.0	260	43	0.11	< 3.0	82	< 30.0	< 0.50	< 8.0	40	230
G-2	6.5	7.0	2.4	< 13.0	26	< 0.30	< 0.80	38	< 3.0	140	300	0.28	< 3.0	77	< 30.0	< 0.50	< 8.0	48	320
G-2	9.75	10.25	2.0	< 13.0	350	< 0.30	< 0.80	32	< 3.0	63	15	0.16	< 3.0	59	< 30.0	< 0.50	< 8.0	25	107
G-2	14.0	14.5	2.4	< 13.0	600	< 0.30	< 0.80	28	< 3.0	110	6.5	0.23	< 3.0	57	< 30.0	< 0.50	< 8.0	35	170
G-3	6.75	7.25	3.9	< 13.0	390	< 0.30	< 0.80	44	< 3.0	169	105	0.39	< 3.0	114	< 30.0	< 0.50	< 8.0	65	480
G-3	11.0	11.5	3.0	< 13.0	490	< 0.30	< 0.80	34	< 3.0	28	7.8	0.11	< 3.0	60	< 30.0	< 0.50	< 8.0	20	65
G-3	14.5	15.0	2.4	< 13.0	220	< 0.30	< 0.80	41	< 3.0	56	17	0.15	< 3.0	79	< 30.0	< 0.50	< 8.0	33	119
G-4	5.0	5.5	< 0.5	< 13.0	27	< 0.30	< 0.80	200	50	11	< 2.0	< 0.10	< 3.0	1600	< 30.0	< 0.50	< 8.0	< 13.0	21
G-4	10.0	10.5	< 0.5	< 13.0	50	< 0.30	< 0.80	140	37	12	< 2.0	< 0.10	< 3.0	940	< 30.0	< 0.50	< 8.0	< 13.0	41
G-4	14.5	15.0	1.5	< 13.0	194	< 0.30	< 0.80	270	33	20	< 2.0	< 0.10	3.8	940	< 30.0	< 0.50	< 8.0	18	27
TTL*			500	500	1000	75	100	2500	8000	2500	1000	20	3500	2000	100	500	700	2400	5000

*Total Threshold Limit Concentration in mg/kg;
California Administrative Code, Title 22, Division 4, Article 11, Section 66699

Note: Metals not detected are shown as less than (<) the corresponding detection limit.

Table 2. Soluble Metal Concentrations in Soil Samples (mg/l)

BORING	SAMPLE DEPTH (FT)		As	Sb	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	Vn	Zn
	TOP	BOTTOM																	
G-1*	7.25	8.25	< 0.02	0.13	2.1	< 0.02	< 0.02	0.22	< 0.10	0.23	5.5	< 0.005	< 0.10	0.87	< 1.0	< 0.01	< 0.30	1.9	22.0
G-1**	7.25	8.25	< 0.02	< 0.05	0.43	< 0.02	< 0.02	< 0.04	< 0.10	< 0.01	< 0.08	< 0.005	0.25	< 0.03	< 1.0	< 0.01	< 0.30	< 0.50	0.52
STLC***			5	15	100	0.75	1	560	80	25	5	0.2	350	20	1	5	7	24	250

* Standard Waste Extraction Test (WET),

** Modified WET, using bay water

*** Soluble Threshold Limit Concentration in mg/l;
California Administrative Code, Title 22, Division 4, Article 11, Section 66699

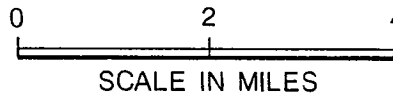
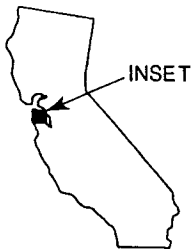
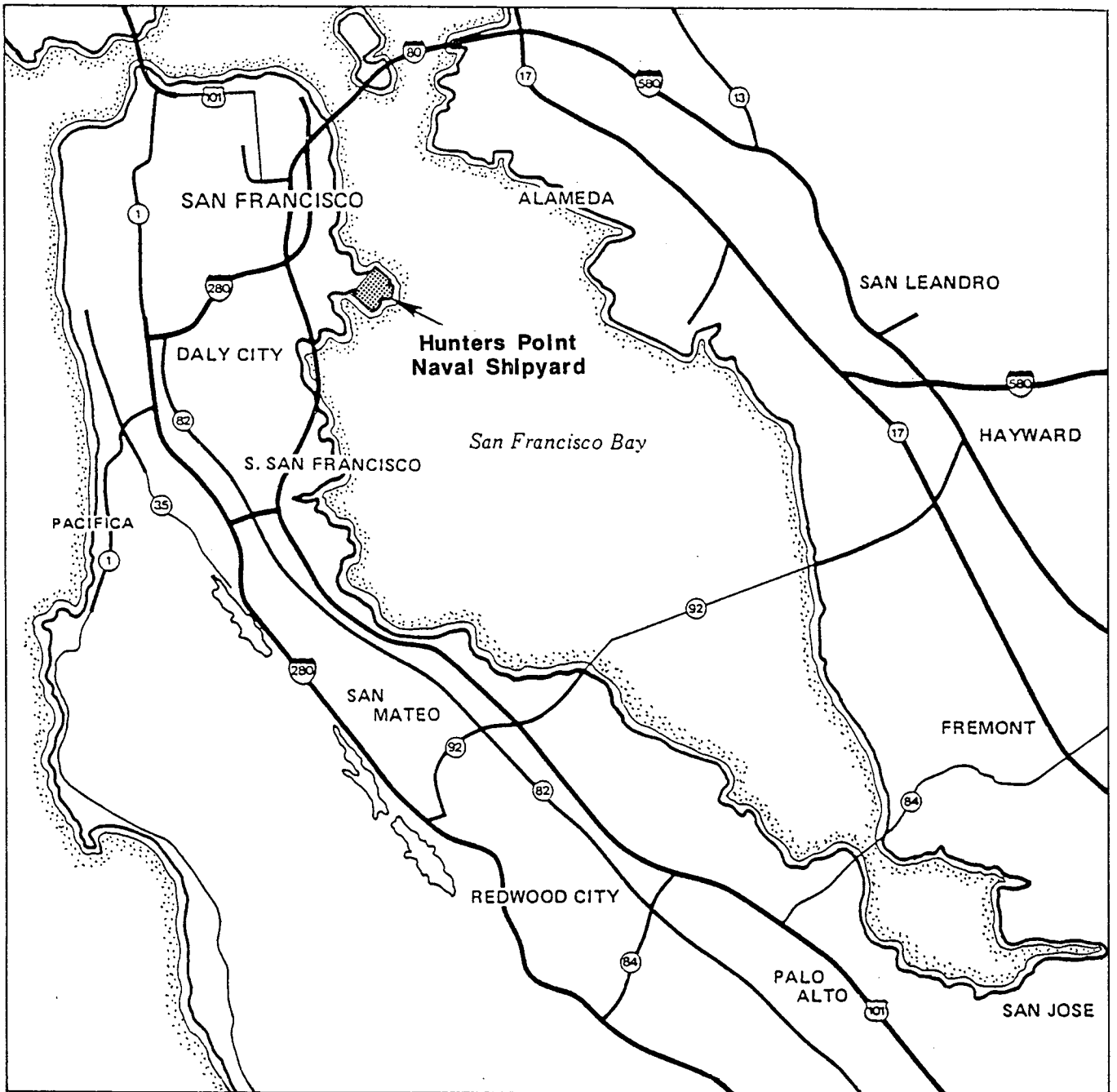
Note: Metals not detected are shown as less than (<) the corresponding detection limit.

Table 3. Dissolved Metal Concentrations in Groundwater Samples (mg/l)

BORING	As	Sb	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mn	Ni	Se	Ag	Tl	Vn	Zn
G-1	< 0.02	0.16	1.4	< 0.01	< 0.01	< 0.02	< 0.04	< 0.05	< 0.05	< 0.001	< 0.15	< 0.05	< 0.02	< 0.01	< 0.04	< 0.10	< 0.06
G-2	< 0.02	0.21	0.30	< 0.01	< 0.01	< 0.02	< 0.04	< 0.05	< 0.05	< 0.001	< 0.15	< 0.05	< 0.02	< 0.01	< 0.04	< 0.10	< 0.06
G-3	0.16	< 0.02	< 0.07	< 0.01	< 0.01	< 0.02	< 0.04	< 0.05	< 0.05	< 0.001	< 0.15	< 0.05	< 0.02	< 0.01	< 0.04	< 0.10	< 0.06
G-4	< 0.02	< 0.02	< 0.07	< 0.01	< 0.01	< 0.02	< 0.04	< 0.05	< 0.05	< 0.001	< 0.15	< 0.05	< 0.02	< 0.01	< 0.04	< 0.10	< 0.06

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 Note: Metals not detected are shown as less than (<) the corresponding detection limit.

PLATES



Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Location Map
Hunters Point Galley
San Francisco, California

PLATE

1

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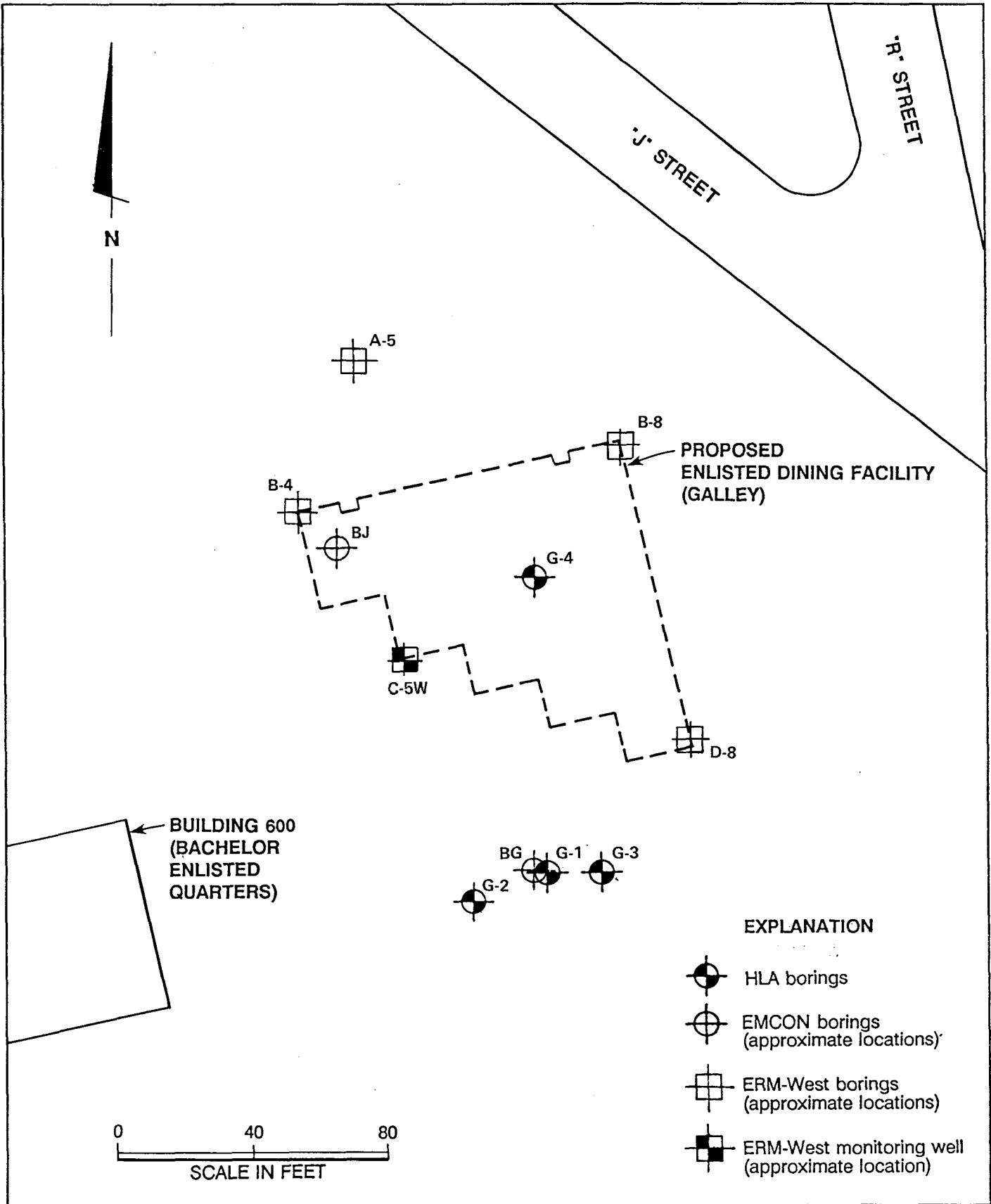
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APPROVED
lot

DATE
6/87

REVISED

DATE



Harding Lawson Associates
Engineers and Geoscientists

Site Plan
Hunters Point Galley
San Francisco, California

PLATE

2

DRAWN
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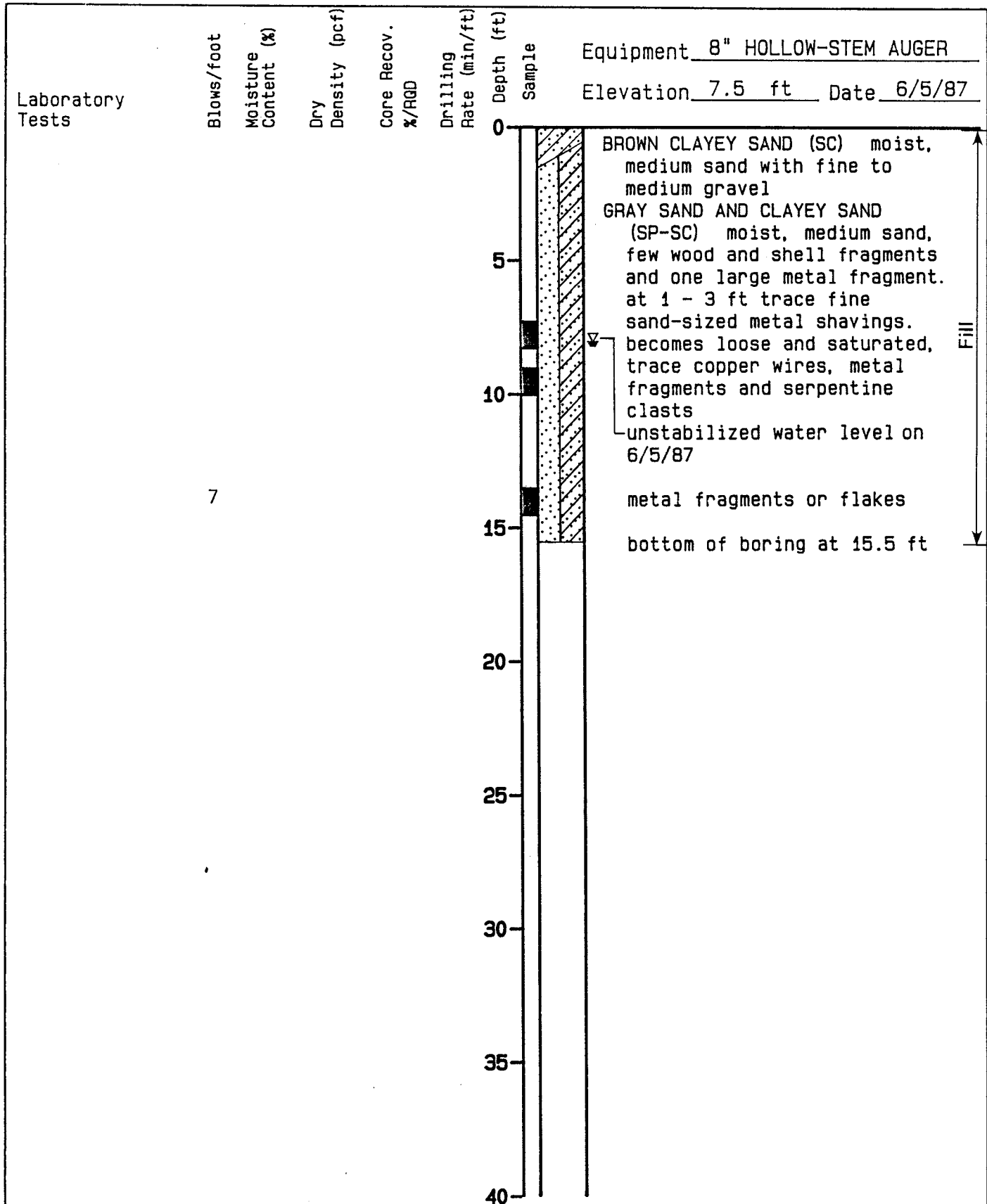
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Log of Boring G-1
Hunters Point Galley
San Francisco, California

PLATE

3

DRAWN
DM

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2, 176, 119.02

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lot

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DATE

Laboratory
Tests

Blows/foot	Moisture Content (%)	Dry Density (pcf)	Core Recov. %/RQD	Drilling Rate (min/ft)	Depth (ft)	Sample
					0	
11						
12						
8					5	
3						
4						
2					10	
7						
12						
12						
3					15	
					20	
					25	
					30	
					35	
					40	

Equipment 8" HOLLOW-STEM AUGER
Elevation 8.5 ft Date 6/5/87

BROWN SANDY CLAY (CL) moist to dry, medium sand, trace gravel
GRAY CLAYEY SAND (SC) moist, medium dense, medium sand and fine gravel, abundant shell fragments
GRAY SAND AND CLAYEY SAND (SP-SC) medium dense to loose, medium sand, abundant shell fragments, serpentine clasts to 2.5 in.
unstabilized water level on 6/5/87
GRAY SAND (SP) loose, moist, medium sand, abundant shell fragments, trace metal flakes
GRAY SAND AND CLAYEY SAND (SP-SC) loose to medium dense, saturated, medium sand, abundant shell fragments
bottom of boring at 17 ft

Fill



Harding Lawson Associates
Engineers and Geoscientists

Log of Boring G-2
Hunters Point Galley
San Francisco, California

PLATE

4

DRAWN
DM

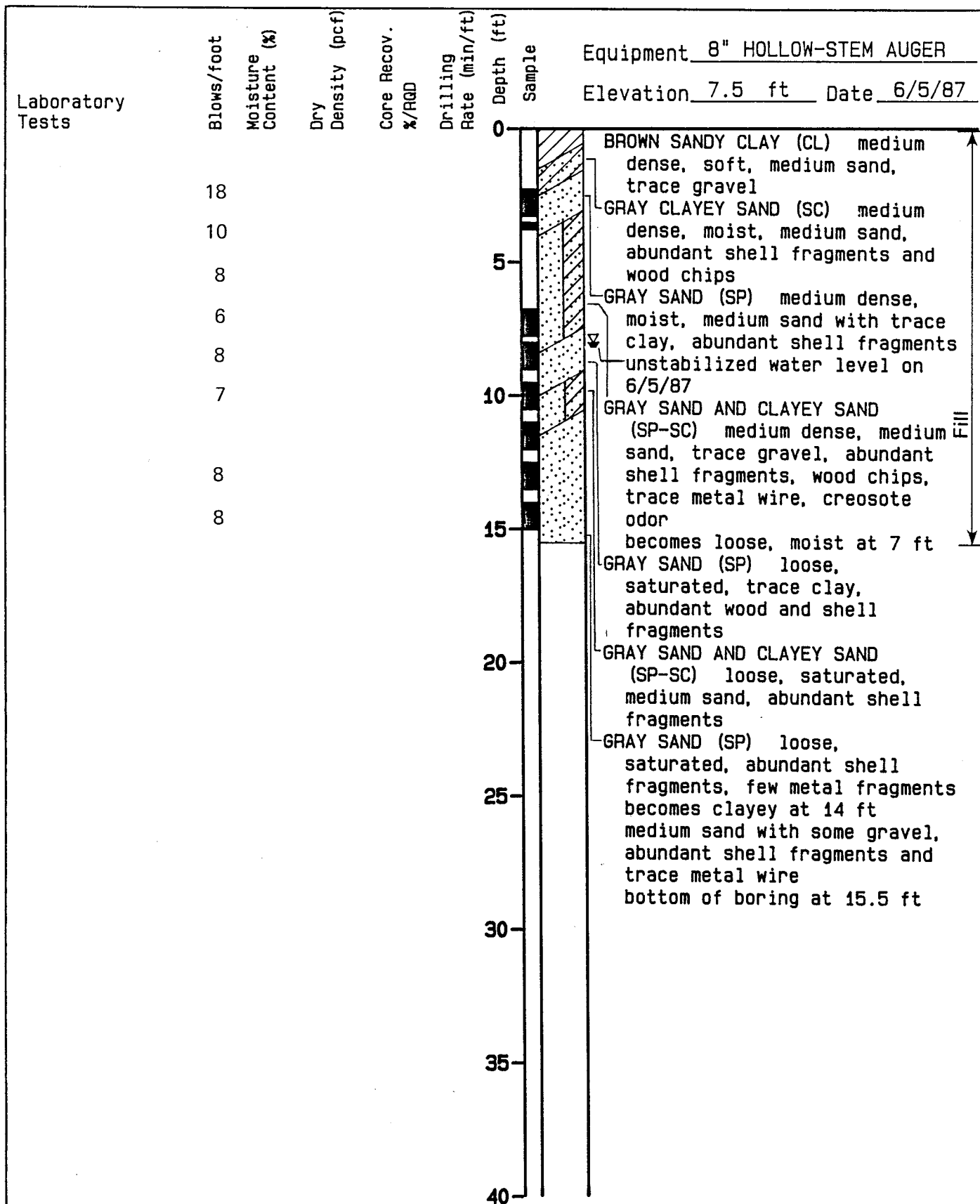
JOB NUMBER
2, 176, 119.02

APPROVED
ht

DATE
6/87

REVISED

DATE



Harding Lawson Associates
Engineers and Geoscientists

Log of Boring 6-3
Hunters Point Galley
San Francisco, California

PLATE

5

DRAWN
DM

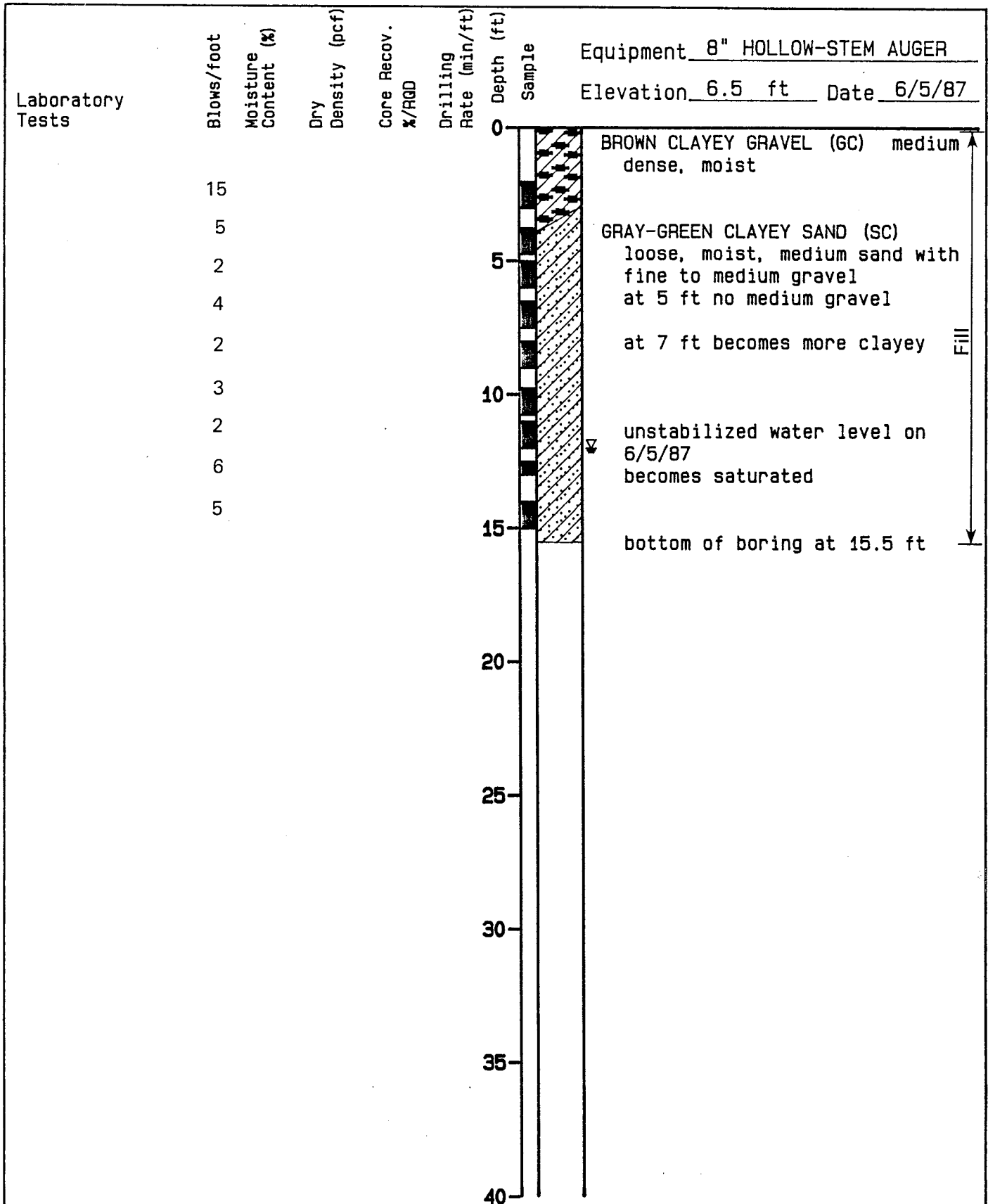
JOB NUMBER
2, 176, 119.02

APPROVED
[Signature]

DATE
6/87

REVISED

DATE



Harding Lawson Associates
Engineers and Geoscientists

Log of Boring 6-4
Hunters Point Galley
San Francisco, California

PLATE

6

DRAWN
DM

JOB NUMBER
2, 176, 119.02

APPROVED
lpt

DATE
6/87

REVISED

DATE

MAJOR DIVISIONS					TYPICAL NAMES
COARSE—GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
			GP		POORLY GRADED GRAVELS WITH OR WITHOUT SAND, LITTLE OR NO FINES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, SILTY GRAVELS WITH SAND
			GC		CLAYEY GRAVELS, CLAYEY GRAVELS WITH SAND
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
			SP		POORLY GRADED SANDS WITH OR WITHOUT GRAVEL, LITTLE OR NO FINES
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE—GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTS WITH SANDS AND GRAVELS
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, CLAYS WITH SANDS AND GRAVELS, LEAN CLAYS
			OL		ORGANIC SILTS OR CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH		ORGANIC SILTS OR CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

UNIFIED SOIL CLASSIFICATION - ASTM D2487-85



Harding Lawson Associates
Engineers and Geoscientists

Unified Soil Classification System
Hunters Point Galley
San Francisco, California

PLATE

7

DRAWN
DM

JOB NUMBER
2,176,119.02

APPROVED

DATE
6/87

REVISED

DATE

Appendix A
SELECTED PREVIOUS DATA

**Total Metal Concentrations
in Soil Samples (mg/kg)***

<u>Boring</u>	<u>Depth (feet)</u>			<u>Cr</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>Sn</u>
BG	2	-	2.5	19	26	17	38	ND **
	4.5	-	5	41	1,800	51	150	ND
	7	-	7.5	29	37,000	120	22,000	ND
BJ	2.5	-	3	24	16	21	28	ND
	7	-	7.5	97	32	18	45	ND
	9.5	-	10	130	26	14	35	ND

*From "Confirmation Study, Verification Step, Hunters Point Naval Shipyard (Disestablished)," March 19, 1987, EMCON Associates (Table 39).

**ND = Not detected. Detection limit was 100 mg/kg.

APPENDIX A
SELECTED PREVIOUS DATA
TABLES 1 AND 2

SUBSURFACE INVESTIGATION, PROPOSED
GALLEY

THE ABOVE IDENTIFIED TABLES ARE NOT
AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY
SOUTHWEST DIVISION TO LOCATE THESE
TABLES. THIS PAGE HAS BEEN INSERTED AS A
PLACEHOLDER AND WILL BE REPLACED SHOULD
THE MISSING ITEMS BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

TABLE 3

PRIORITY POLLUTANT METALS DETECTED IN SOIL
 SAMPLES COLLECTED AT THE GALLEY SITES

PROPOSED GALLEY SITE

CONSTITUENT	BORING D8 1.75'-2.25' 3.00'-3.50'	BORING D8 6.00'-6.50'	BORING D8 8.17'-8.67' 10.33'-10.83'	BORING C5W 2.33'-2.83' 5.25'-5.75'	BORING C5W 7.00'-7.50' 9.50' 11.00'-11.50'	BORING C5W 12.50'-13.00' 14.00'-14.50'	BORING B4 1.83'-2.33' 4.50'-5.00'	BORING B4 6.75'-7.25'	BORING B4 8.50'-9.00' 9.50'-10.00'	(1) REGULATORY STANDARD or ACTION LIMIT	
										STLC	TTLc
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/l)	(mg/kg)
		(2)			(2)	(2)					
Antimony	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05/<0.05	0.07	<0.05	15	500
Arsenic	1.8	0.13/0.20	1.0	1.2	1.0	2.0/1.5	1.4/1.4	2.5	1.9	5.0	500
Beryllium	0.2	<0.1/<0.1	0.1	0.2	0.2	0.2/0.2	0.2/0.1	0.2	0.1	0.75	75
Cadmium	0.75	0.70/0.68	0.64	0.89	0.82	0.71/0.70	0.95/1.1	1.5	0.77	1.0	100
Chromium, Total	100	130/130	130	38	63	90/73	39/47	49	47	5	500
Copper	48	20/22	8.7	46	44	34/39	72/79	150	44	25	2,500
Lead	19	14/16	12	37	16	14/15	30/33	260	16	5.0	1000
Mercury	0.11	0.049/0.066	0.023	0.071	0.055	0.034/0.046	2.0/.99	0.16	0.037	0.2	20
Nickel	190	550/540	480	51	84	150/130	58/60	70	66	20	2,000
Selenium	<0.05	<0.05/<0.05	<0.05	<0.05	<0.05	<0.05/<0.05	<0.05/<0.05	<0.05	<0.05	1.0	100
Silver	0.7	0.4/0.4	0.4	0.8	0.7	0.7/0.7	0.7/0.8	1.7	0.7	5	500
Thallium	9.5	11/10	10	8.4	8.6	8.8/7.9	8.1/8.7	7.4	8.4	7.0	700
Zinc	48	24/38	32	55	48	47/41	79/94	350	47	250	5,000

NOTES:

- (1) Soluble Threshold Limit Concentration (STLC)
 Total Threshold Limit Concentration (TTLc)
 STLC and TTLc values from California Administrative Code, Title 22
 Section 66699, Adopted January 12, 1985

- (2) Initial analysis/duplicate analysis

TABLE 3
(continued)

PROPOSED GALLEY SITE

CONSTITUENT							(1)	
	BORING A5 2.18'-2.67'	BORING A5 cuttings 7.00'-8.50'	BORING A5 cuttings 11.5'	BORING B8 1.83'-2.33'	BORING B8 8.75'-9.25'	BORING B8 11.00'-11.50'	REGULATORY STANDARD or ACTION LIMIT	
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	STLC (mg/l)	TTLC (mg/kg)
Antimony	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	15	500
Arsenic	4.5	1.4	1.3	0.38	0.06	<0.05	5.0	500
Beryllium	0.3	0.2	0.2	0.1	<0.1	<0.1	0.75	75
Cadmium	0.63	1.2	0.70	0.8	0.59	0.46	1.0	100
Chromium, Total	73	77	78	150	500	200	5	500
Copper	49	90	54	69	7.2	8.7	25	2,500
Lead	18	55	29	37	11	9.4	5.0	1000
Mercury	0.058	0.34	0.14	0.32	0.004	0.012	0.2	20
Nickel	130	130	120	430	620	600	20	2,000
Selenium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.0	100
Silver	0.6	0.9	0.6	0.4	0.3	0.3	5	500
Thallium	7.9	11	7.9	8.7	10	8.8	7.0	700
Zinc	63	120	76	66	20	20	250	5,000

NOTES:

- (1) Soluble Threshold Limit Concentration (STLC)
Total Threshold Limit Concentration (TTLC)
STLC and TTLC values from California Administrative Code, Title 22

APPENDIX A
SELECTED PREVIOUS DATA
TABLE 4

SUBSURFACE INVESTIGATION, PROPOSED
GALLEY

THE ABOVE IDENTIFIED TABLE IS NOT AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY
SOUTHWEST DIVISION TO LOCATE THIS TABLE.

THIS PAGE HAS BEEN INSERTED AS A
PLACEHOLDER AND WILL BE REPLACED SHOULD
THE MISSING ITEM BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

TABLE 5
CHEMICAL CONSTITUENTS
DETECTED IN SHALLOW GROUNDWATER
SAMPLES COLLECTED AT THE GALLEY SITE

Constituent	Well C5-W, mg/l	Well B5a-W mg/l	(1) Regulatory Standard or Action Limit, mg/l
METALS			
Antimony	<0.005	<0.005	--
Arsenic	<0.005	0.022	0.05
Beryllium	<0.01	<0.01	--
Cadmium	0.024	0.017	0.010
Chromium, Total	0.053	0.58	0.050
Copper	<0.05	0.29	1.0
Lead	0.13	0.16	0.05
Mercury	<0.0002	0.0004	0.002
Nickel	0.26	0.88	--
Selenium	<0.005	<0.005	0.01
Silver	0.01	0.01	0.05
Thallium	0.18	0.18	--
Zinc	0.10	0.52	5.0
EXTRACTABLE ORGANICS			
	(2)	(3)	
Bis(2-ethylhexyl)- phthalate	0.005	---	--
Naphthalene	0.002	---	--

NOTES:

- (1) Primary and Secondary Drinking Water "Maximum Contaminant Level", Standards and Guidelines for Domestic Water Supply, Volume I, Water Quality and Monitoring, Department of Health Services, Sanitary Engineering Branch, State of California
- (2) Semivolatile organic compounds exceeding detection limits are summarized in this table. See appendixes for a complete list of compounds included in the analysis.
- (3) None detected

Appendix B
CERTIFIED LABORATORY REPORTS

Appendix B

Harding Lawson Associates

<u>Sample ID Numbers</u>	<u>Boring</u>	<u>Depth (Feet)</u>
87230003	G-1	Water
87230004	Trip Blank	
87230005	G-1	13.5 - 14.5
87230002	G-1	13.5 - 14.5
87230006	G-2	6.5 - 7.0
87230007	G-2	9.75 - 10.25
87230008	G-2	14.0 - 14.5
87230009	G-2	Water
87230010	G-3	6.75 - 7.25
87230011	G-3	11.0 - 11.5
87230012	G-3	14.5 - 15.0
87230013	G-3	Water
87230014	G-4	5.0 - 5.5
87230015	G-4	10.0 - 10.5
87230016	G-4	14.5 - 15.0
87230017	G-4	Water
87230018	G-1	7.25 - 8.25
87230018 (WET)	G-1	7.25 - 8.25
87230018 (WET, Modified)	G-1	7.25 - 8.25

LABORATORY CERTIFICATE

received 6/15/87
2176, 119.02
Hunters Point Galley



Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878

290 Division Street, San Francisco, CA 94103, Phone (415) 861-1863

Laboratory No. 12864
Preliminary No.

Reported June 11, 1987
Sampled
Received June 5, 1987

For Harding Lawson Associates

Report on Seventeen Soil and Water Samples

Mark Job ID #87-3175.02

Sample ID Numbers:

- | | |
|-------------|---------------------------|
| 1) 87230003 | 10) 87230011 |
| 2) 87230004 | 11) 87230012 |
| 3) 87230005 | 12) 87230013 |
| 4) 87230002 | 13) 87230014 |
| 5) 87230006 | 14) 87230015 |
| 6) 87230007 | 15) 87230016 |
| 7) 87230008 | 16) 87230017 |
| 8) 87230009 | 17) 87230018 |
| 9) 87230010 | 17(A)) CAM EXT. 87230018 |
| | 17(B)) MODIFIED 87230018 |


Laboratory Director

LAB NUMBER: 12864-1
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230003
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	ND	0.02	EPA 7041
Antimony	0.16	0.02	EPA 7060
Barium	1.4	0.07	EPA 7080
Beryllium	ND	0.01	EPA 7090
Cadmium	ND	0.01	EPA 7130
Chromium	ND	0.02	EPA 7190
Cobalt	ND	0.04	EPA 214.1
Copper	ND	0.05	EPA 7010
Lead	ND	0.05	EPA 7420
Mercury	ND	0.001	EPA 7470
Molybdenum	ND	0.15	EPA 246.1
Nickel	ND	0.05	EPA 7520
Selenium	ND	0.02	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.04	EPA 7840
Vanadium	ND	0.10	EPA 7910
Zinc	ND	0.06	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	104	Mercury	1	97
Selenium	--	--	Beryllium	1	100
Antimony	1	89	Thallium	1	105
Zinc	1	104	Copper	1	102
Lead	1	106	Chromium	1	82
Cadmium	1	100	Cobalt	1	96
Nickel	1	102	Silver	1	107
Barium	7	95	Vanadium	1	106
Molybdenum	1	108			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-2
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230004
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	ND	0.02	EPA 7041
Antimony	ND	0.02	EPA 7060
Barium	ND	0.07	EPA 7080
Beryllium	ND	0.01	EPA 7090
Cadmium	ND	0.01	EPA 7130
Chromium	ND	0.02	EPA 7190
Cobalt	ND	0.04	EPA 214.1
Copper	ND	0.05	EPA 7010
Lead	ND	0.05	EPA 7420
Mercury	ND	0.001	EPA 7470
Molybdenum	ND	0.15	EPA 246.1
Nickel	ND	0.05	EPA 7520
Selenium	ND	0.02	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.04	EPA 7840
Vanadium	ND	0.10	EPA 7910
Zinc	ND	0.06	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	104	Mercury	1	97
Selenium	--	--	Beryllium	1	100
Antimony	1	89	Thallium	1	105
Zinc	1	104	Copper	1	102
Lead	1	106	Chromium	1	82
Cadmium	1	100	Cobalt	1	96
Nickel	1	102	Silver	1	107
Barium	7	95	Vanadium	1	106
Molybdenum	1	108			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-3
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230005
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	2.2	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	350	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	53	3.0	EPA 7190
Cobalt	8.0	3.0	EPA 214.1
Copper	300	3.0	EPA 7010
Lead	55	2.0	EPA 7420
Mercury	0.14	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	120	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	48	13.0	EPA 7910
Zinc	240	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-4
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230002
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	2.1	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	210	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	41	0.80	EPA 7130
Chromium	ND	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	260	3.0	EPA 7010
Lead	43	2.0	EPA 7420
Mercury	0.11	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	82	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	40	13.0	EPA 7910
Zinc	230	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenu	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-5
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230006
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	2.4	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	26	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	38	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	140	3.0	EPA 7010
Lead	300	2.0	EPA 7420
Mercury	0.28	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	77	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	48	13.0	EPA 7910
Zinc	320	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-6
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230007
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	2.0	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	350	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	32	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	63	3.0	EPA 7010
Lead	15	2.0	EPA 7420
Mercury	0.16	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	59	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	25	13.0	EPA 7910
Zinc	107	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-7
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230008
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	2.4	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	600	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	28	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	110	3.0	EPA 7010
Lead	6.5	2.0	EPA 7420
Mercury	0.23	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	57	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	35	13.0	EPA 7910
Zinc	170	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-8
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230009
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	ND	0.02	EPA 7041
Antimony	0.21	0.02	EPA 7060
Barium	0.30	0.07	EPA 7080
Beryllium	ND	0.01	EPA 7090
Cadmium	ND	0.01	EPA 7130
Chromium	ND	0.02	EPA 7190
Cobalt	ND	0.04	EPA 214.1
Copper	ND	0.05	EPA 7010
Lead	ND	0.05	EPA 7420
Mercury	ND	0.001	EPA 7470
Molybdenum	ND	0.15	EPA 246.1
Nickel	ND	0.05	EPA 7520
Selenium	ND	0.02	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.04	EPA 7840
Vanadium	ND	0.10	EPA 7910
Zinc	ND	0.06	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	104	Mercury	1	97
Selenium	--	--	Beryllium	1	100
Antimony	1	89	Thallium	1	105
Zinc	1	104	Copper	1	102
Lead	1	106	Chromium	1	82
Cadmium	1	100	Cobalt	1	96
Nickel	1	102	Silver	1	107
Barium	7	95	Vanadium	1	106
Molybdenum	1	108			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-9
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230010
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	3.9	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	390	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	44	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	169	3.0	EPA 7010
Lead	105	2.0	EPA 7420
Mercury	0.39	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	114	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	65	13.0	EPA 7910
Zinc	480	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenu	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Varadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-10
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230011
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	3.0	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	490	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	34	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	28	3.0	EPA 7010
Lead	7.8	2.0	EPA 7420
Mercury	0.11	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	60	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	20	13.0	EPA 7910
Zinc	65	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenu	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-11
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230012
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	2.4	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	220	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	41	3.0	EPA 7190
Cobalt	ND	3.0	EPA 214.1
Copper	56	3.0	EPA 7010
Lead	17	2.0	EPA 7420
Mercury	0.15	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	79	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	33	13.0	EPA 7910
Zinc	119	13.0	EPA 7950

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QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenu	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-12
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230013
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	0.16	0.02	EPA 7041
Antimony	ND	0.02	EPA 7060
Barium	ND	0.07	EPA 7080
Beryllium	ND	0.01	EPA 7090
Cadmium	ND	0.01	EPA 7130
Chromium	ND	0.02	EPA 7190
Cobalt	ND	0.04	EPA 214.1
Copper	ND	0.05	EPA 7010
Lead	ND	0.05	EPA 7420
Mercury	ND	0.001	EPA 7470
Molybdenum	ND	0.15	EPA 246.1
Nickel	ND	0.05	EPA 7520
Selenium	ND	0.02	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.04	EPA 7840
Vanadium	ND	0.10	EPA 7910
Zinc	ND	0.06	EPA 7950

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QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	104	Mercury	1	97
Selenium	--	--	Beryllium	1	100
Antimony	1	89	Thallium	1	105
Zinc	1	104	Copper	1	102
Lead	1	106	Chromium	1	82
Cadmium	1	100	Cobalt	1	96
Nickel	1	102	Silver	1	107
Barium	7	95	Vanadium	1	106
Molybdenum	1	108			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-13
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230014
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	ND	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	27	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	200	3.0	EPA 7190
Cobalt	50	3.0	EPA 214.1
Copper	11	3.0	EPA 7010
Lead	ND	2.0	EPA 7420
Mercury	ND	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	1600	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	ND	13.0	EPA 7910
Zinc	21	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-14
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230015
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	ND	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	50	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	140	3.0	EPA 7190
Cobalt	37	3.0	EPA 214.1
Copper	12	3.0	EPA 7010
Lead	ND	2.0	EPA 7420
Mercury	ND	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	940	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	ND	13.0	EPA 7910
Zinc	41	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-15
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230016
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	1.5	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	194	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	270	3.0	EPA 7190
Cobalt	33	3.0	EPA 214.1
Copper	20	3.0	EPA 7010
Lead	ND	2.0	EPA 7420
Mercury	ND	0.10	EPA 7470
Molybdenum	3.8	3.0	EPA 246.1
Nickel	940	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	18	13.0	EPA 7910
Zinc	27	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-16
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230017
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	ND	0.02	EPA 7041
Antimony	ND	0.02	EPA 7060
Barium	ND	0.07	EPA 7080
Beryllium	ND	0.01	EPA 7090
Cadmium	ND	0.01	EPA 7130
Chromium	ND	0.02	EPA 7190
Cobalt	ND	0.04	EPA 214.1
Copper	ND	0.05	EPA 7010
Lead	ND	0.05	EPA 7420
Mercury	ND	0.001	EPA 7470
Molybdenum	ND	0.15	EPA 246.1
Nickel	ND	0.05	EPA 7520
Selenium	ND	0.02	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.04	EPA 7840
Vanadium	ND	0.10	EPA 7910
Zinc	ND	0.06	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	104	Mercury	1	97
Selenium	--	--	Beryllium	1	100
Antimony	1	89	Thallium	1	105
Zinc	1	104	Copper	1	102
Lead	1	106	Chromium	1	82
Cadmium	1	100	Cobalt	1	96
Nickel	1	102	Silver	1	107
Barium	7	95	Vanadium	1	106
Molybdenum	1	108			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-17
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230018
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: EPA METHOD 3010

METAL	CONC (mg/Kg)	DETECTION LIMIT (mg/Kg)	METHOD
Arsenic	3.4	0.5	EPA 7041
Antimony	ND	13.0	EPA 7060
Barium	430	13.0	EPA 7080
Beryllium	ND	0.30	EPA 7090
Cadmium	ND	0.80	EPA 7130
Chromium	34	3.0	EPA 7190
Cobalt	4	3.0	EPA 214.1
Copper	350	3.0	EPA 7010
Lead	150	2.0	EPA 7420
Mercury	0.26	0.10	EPA 7470
Molybdenum	ND	3.0	EPA 246.1
Nickel	69	13.0	EPA 7520
Selenium	ND	30.0	EPA 7740
Silver	ND	0.50	EPA 7760
Thallium	ND	8.0	EPA 7840
Vanadium	48	13.0	EPA 7910
Zinc	690	13.0	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	102	Mercury	12	94
Antimony	1	97	Molybdenum	1	84
Barium	1	100	Nickel	4	97
Beryllium	1	78	Selenium	1	110
Cadmium	1	88	Silver	1	86
Chromium	11	109	Thallium	1	99
Cobalt	1	97	Vanadium	12	97
Copper	7	98	Zinc	5	100
Lead	1	93			

ND = NONE DETECTED. mg/Kg = parts per million.



Curtis & Tompkins, Ltd.

LAB NUMBER: 12864-17
CLIENT: HARDING LAWSON ASSOCIATES
CLIENT ID: 87230018
JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
DATE ANALYZED: 06/08-11/87
DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
DIGESTION METHOD: CALIFORNIA WET EXTRACTION CAC 66700

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	ND	0.02	EPA 7041
Antimony	0.13	0.05	EPA 7060
Barium	2.1	0.02	EPA 7080
Beryllium	ND	0.02	EPA 7090
Cadmium	ND	0.02	EPA 7130
Chromium	0.22	0.04	EPA 7190
Cobalt	ND	0.10	EPA 214.1
Copper	0.23	0.01	EPA 7010
Lead	5.5	0.08	EPA 7420
Mercury	ND	0.005	EPA 7470
Molybdenum	ND	0.10	EPA 246.1
Nickel	0.87	0.03	EPA 7520
Selenium	ND	1.0	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.30	EPA 7840
Vanadium	1.9	0.50	EPA 7910
Zinc	22.0	0.05	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	9	80	Mercury	--	95
Antimony	1	89	Molybdenum	1	90
Barium	4	107	Nickel	1	99
Beryllium	1	94	Selenium	1	95
Cadmium	1	104	Silver	1	99
Chromium	1	97	Thallium	1	101
Cobalt	1	97	Vanadium	--	99
Copper	1	97	Zinc	1	99
Lead	1	105			

ND = NONE DETECTED. mg/Kg = parts per million.

LAB NUMBER: 12864-17
 CLIENT: HARDING LAWSON ASSOCIATES
 CLIENT ID: 87230018
 JOB ID: 87-3175.02

DATE RECEIVED: 06/05/87
 DATE ANALYZED: 06/08-11/87
 DATE REPORTED: 06/11/87

CAM 17 METALS BY ATOMIC ABSORPTION SPECTROPHOTOMETRY
 DIGESTION METHOD: MODIFIED CALIFORNIA WET EXTRACTION

METAL	CONC (mg/L)	DETECTION LIMIT (mg/L)	METHOD
Arsenic	ND	0.02	EPA 7041
Antimony	ND	0.05	EPA 7060
Barium	0.43	0.02	EPA 7080
Beryllium	ND	0.02	EPA 7090
Cadmium	ND	0.02	EPA 7130
Chromium	ND	0.04	EPA 7190
Cobalt	ND	0.10	EPA 214.1
Copper	ND	0.01	EPA 7010
Lead	ND	0.08	EPA 7420
Mercury	ND	0.005	EPA 7470
Molybdenum	0.25	0.10	EPA 246.1
Nickel	ND	0.03	EPA 7520
Selenium	ND	1.0	EPA 7740
Silver	ND	0.01	EPA 7760
Thallium	ND	0.30	EPA 7840
Vanadium	ND	0.50	EPA 7910
Zinc	0.52	0.05	EPA 7950

=====

QA - QC SUMMARY

	%RPD	%SPIKE		%RPD	%SPIKE
Arsenic	1	92	Mercury	--	105
Antimony	1	98	Molybdenum	8	97
Barium	1	92	Nickel	1	92
Beryllium	1	82	Selenium	1	95
Cadmium	1	108	Silver	1	96
Chromium	1	85	Thallium	1	102
Cobalt	1	96	Vanadium	--	102
Copper	1	105	Zinc	1	100
Lead	1	102			

ND = NONE DETECTED. mg/Kg = parts per million.

Appendix C
BIOASSAY REPORT

2176, 119.02
Honkers Pt. Galley
Jab

ATT

June 12, 1987.

Mr. Ronald M. Block
Aqua Terra Technologies,
2950 Buskirk Avenue, Suite 120
Walnut Creek, CA 94596-2314

Subject: Test Results for Soil Core Sample
680 (873172.02)

Dear Ron:

This letter report presents the toxicity test results for fathead minnow (Pimephales promelas) exposed to concentrations of soil core samples provided by Harding Lawson Associates.

METHODS

All tests were conducted according to Aqua Terra Technologies (ATT) hazardous waste aquatic toxicity test protocol based on Standard Methods for the Examination of Water and Wastewater, 16th Edition, American Public Health Association, 1986, and certified by the State of California Department of Health Services (copy of certificate attached). The soil core sample was tested at three concentrations, 250 mg/L, 500 mg/L, and 750 mg/L. The soil sample was thoroughly mixed into dechlorinated tap water using a wrist-action shaker. All treatments were run in duplicate with 10 fish per three liter tank and a total of 20 fish per treatment. Temperature was controlled at $20 \pm 2^{\circ}\text{C}$ and photoperiod regulated at approximately 16-hours light and 8-hours dark. Fish were acclimated in the test laboratory for one day prior to their use in these tests.

Fish mortality and the following physical chemical variables were monitored during the 96-hours test: temperature, pH, dissolved oxygen concentration and water hardness.

TEST RESULTS

No fish mortality occurred in the dilution water control. Five percent fish mortality occurred at 250 mg/L exposure concentration and no fish mortality occurred at 500 mg/L exposure concentration.

Aqua Terra Technologies
Consulting Engineers
Scientists

2950 Buskirk Avenue
Suite 120
Walnut Creek, CA
94596
916-934-4884

Mr. Ronald M. Block
Aqua Terra Technologies, Inc.
June 11, 1987.
Page Two

Forty percent fish mortality occurred at the 750 mg/L concentration. The raw data from tests are summarized in the attached data sheets.

Test results indicate that the 96-hour LC50 values for the soil sample is greater than 500 mg/L. The soil core sample therefore does not meet the acute aquatic toxicity test criteria (96-hour LC50 \leq 500 mg/L) for identification of a material as hazardous, according to the specification in the California Administration Code, Title 22, Division 4, Article 11, Section 66696.

Should any questions arise as to test procedures or results, do not hesitate to call.

Very truly yours,

AQUA TERRA TECHNOLOGIES, INC.



Patrick J. Sheehan, Ph.D.
Laboratory Director

PJS/dbh

Enclosures: Bioassay Data Sheet
Temperature Trace
Invoice
Certificate

STATIC ACUTE BIOASSAY

CLIENT: Harding Lawson Associates ATTENTION: Ms. Lisa Teague

SAMPLE ID#: control SAMPLE DESCRIPTION: dilution water TESTING DATES: 06/08/87- 06/12/87

TEST CONC	INITIAL Monday				24-HOUR Tuesday				48-HOUR Wednesday				72-HOUR Thursday				96-HOUR Friday			
	.Hard	pH	DO	Temp	.Dead	pH	DO	Temp	.Dead	pH	DO	Temp	.Dead	pH	DO	Temp	.Dead	pH	DO	Temp
	mg/L		mg/L	°C			mg/L	°C			mg/L	°C			mg/L	°C			mg/L	°C
control #1	.45	7.63	8.3	*	.0	7.55	8.1	*	.0	7.54	8.2		.0	7.52	8.0	*	.0	7.54	8.0	*
control #2		7.57	8.2		.0	7.46	7.9		.0	7.55	8.3		.0	7.54	7.8		.0	7.56	8.1	

Test Species fathead minnows AVG Length 22.3 cm MAX Length 32.0 cm MIN Length 18.0 cm

Source of Test Species Thomas Fish Company AVG Wt 0.21 gm MAX Wt 0.5 gm MIN Wt 0.1 gm
10/tank

Species Density 20/treatment Dilution Water dechlorinated tap Test Soln Vol 3L Depth 17cm Aeration bubble

Acclimation Tank % Dead <1 Acc. Tank Water dechlorinated tap Acc. Period 1 Acc. Temp. 20(+/-2)deg C

REMARKS: *continuous temperature recording on disc.

TECHNICIAN: Patricia Chiang

LABORATORY DIRECTOR: Patrick J. Sheehan, Ph.D.

ATTN

STATIC ACUTE BIOASSAY

CLIENT: Harding Lawson Associates ATTENTION: Ms. Lisa Teague

SAMPLE ID#: 680(873172.02) SAMPLE DESCRIPTION: soil core TESTING DATES: 06/08/87- 06/12/87

TEST CONC	INITIAL Monday				24-HOUR Tuesday				48-HOUR Wednesday				72-HOUR Thursday				96-HOUR Friday			
	.Hard	pH	DO	Temp	.Dead	pH	DO	Temp	.Dead	pH	DO	Temp	.Dead	pH	DO	Temp	.Dead	pH	DO	Temp
	mg/L		mg/L	°C			mg/L	°C			mg/L	°C			mg/L	°C			mg/L	°C
250 mg/L #3	.	8.00	8.1	*	. 0	7.00	6.3	*	. 1	7.53	8.0	*	. 1	7.65	7.9	*	. 1	7.70	7.8	*
250 mg/L #4	.	7.57	8.0	.	. 0	6.97	6.3	.	. 0	7.65	8.1	.	. 0	7.74	7.9	.	. 0	7.77	8.1	.
500 mg/L #5	.	8.28	8.2	.	. 0	7.43	7.6	.	. 0	7.53	7.7	.	. 0	7.57	7.5	.	. 0	7.54	7.4	.
500 mg/L #6	.	8.14	8.2	.	. 0	7.59	7.7	.	. 0	7.65	7.8	.	. 0	7.59	7.5	.	. 0	7.63	7.6	.
750 mg/L #7	.	8.28	8.3	.	. 0	7.80	8.2	.	. 0	7.86	8.2	.	. 0	7.89	8.1	.	. 0	7.90	8.1	.
750 mg/L #8	.	8.47	8.2	.	. 0	7.77	8.1	.	. 0	7.77	7.9	.	. 5	7.76	7.6	.	. 8	7.80	8.0	.

Test Species fathead minnows AVG Length 22.3 cm MAX Length 32.0 cm MIN Length 18.0 cm

Source of Test Species Thomas Fish Company AVG Wt 0.21 gm MAX Wt 0.5 gm MIN Wt 0.1 gm
10/tank

Species Density 20/treatment Dilution Water dechlorinated tap Test Soln Vol 3L Depth 17cm Aeration bubble

Acclimation Tank % Dead <1 Acc. Tank Water dechlorinated tap Acc. Period 1 Acc. Temp. 20(+/-2)deg C

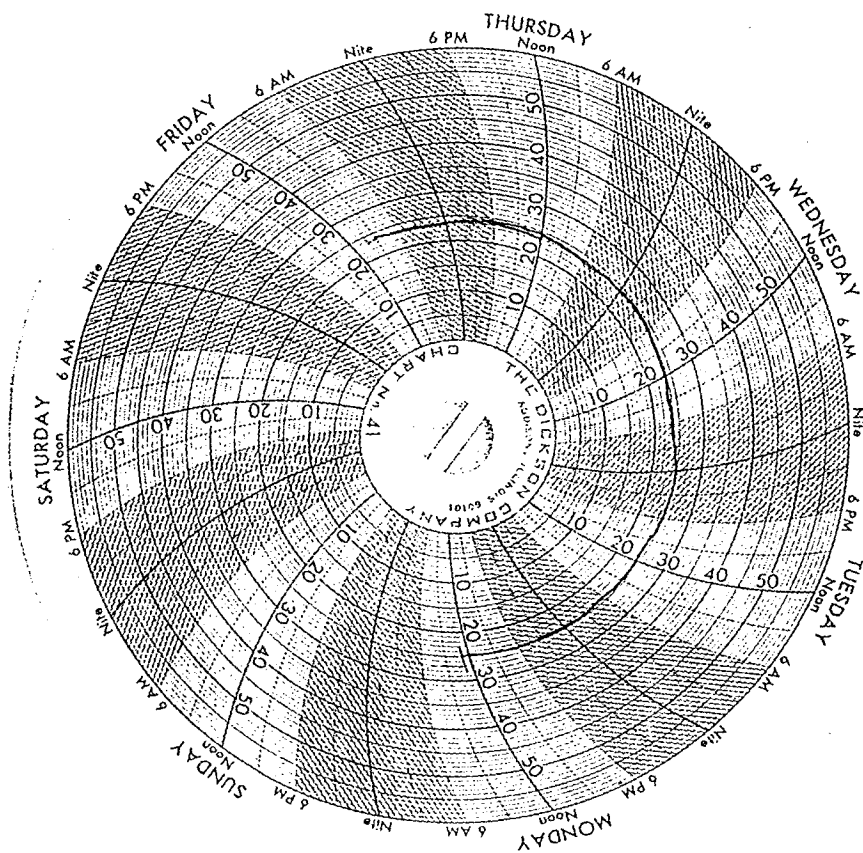
REMARKS: *continuous temperature recording on disc.

TECHNICIAN: Patricia Chiang

LABORATORY DIRECTOR: Patrick J. Sheehan, Ph.D.

ATTN

control
680



APPENDIX C
BIOASSAY REPORT

ENCLOSURE (3) - INVOICE

SUBSURFACE INVESTIGATION, PROPOSED
GALLEY

THE ABOVE IDENTIFIED ENCLOSURES ARE NOT
AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY
SOUTHWEST DIVISION TO LOCATE THESE
ENCLOSURES. THIS PAGE HAS BEEN INSERTED
AS A PLACEHOLDER AND WILL BE REPLACED
SHOULD THE MISSING ITEMS BE LOCATED.

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

APPENDIX C
BIOASSAY REPORT

ENCLOSURE (4) – CERTIFICATE

SUBSURFACE INVESTIGATION, PROPOSED
GALLEY

THE ABOVE IDENTIFIED ENCLOSURES ARE NOT
AVAILABLE.

EXTENSIVE RESEARCH WAS PERFORMED BY
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